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Seagate

SPECIFICATION
BAG,ESD PROTECTION

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Sheet 1 OF 12

Seagate Technology, Inc.
Twin City Operations

REVISION RECORD				
REV	MCO	DESCRIPTION	DATE	APPROVAL
A	SJP3733	Production Release/ Sal Enea	12/04/97	R. Milton
B	WTP10432	Revise per requirements of 15706-TAB; Increase sample size	9/21/99	R. Milton
C	DJP02654	Revised per MCO DJP02654	1/16/01	Jay Hazekamp

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1 PURPOSE

Establish detailed electrical and cleanliness level acceptance criteria for Electro Static Discharge bags (i.e. ESD shielding and moisture barrier bags and pouches) used to store and transport parts such as HGAs, E-Blocks, PCBs, and other ESD sensitive disc drive assembly components.

2 SCOPE

This specification applies to all Seagate facilities worldwide, and to ESD bag suppliers. This specification does not address application specific properties of ESD bags such as burst and tear strength, puncture resistance, printability, mechanical and dimensional tolerances, etc. These requirements shall be listed in the latest revision of Seagate Specification 15706-TAB.

3 APPLICABLE DOCUMENTS

- ANSI/EOS/ESD S11.11 - 1993 *Surface Resistance Measurement of Static Dissipative Planar Materials*
- ANSI/ESD S11.31 - 1994 *Shielding Materials - Bags*
- ANSI/EOS/ESD S5.1 - 1993 *Human Body Model (HBM) - Component Level*
- EOS/ESD Advisory I - 1993 *Glossary of Terms*
- ANSI/EOS/ESD S3.1 - *1991 Ionization* (Charged Plate Monitor)
- ESD Handbook ADV 2.0 - 1994 *Section 16 Symbols*
- ST1027 - Seagate EOS/ESD Control Program Specification
- 30288-001 Seagate Supplier Packaging Standards
- 35344-001 Specification, Test Methods, Cleanroom Consumables
- 15706-TAB Engineering Specification, Bags, Static Shielding

4 DEFINITIONS

- Charge Retention – the ability or propensity of a laminated packaging material to trap a static charge on the conductive layer.
- Electrostatic Shield – a barrier or enclosure that limits the penetration of an electrostatic field.
- Electrostatic Discharge Shield – a barrier or enclosure that limits the passage of current and attenuates an electromagnetic field resulting from an electrostatic discharge.
- ANSI/EOS/ESD S8.1 *Glossary*

5 MATERIAL OF CONSTRUCTION

Refer to Seagate Specification 15706-TAB for the required materials.

6 DESIGN REQUIREMENTS

Physical properties such as the material thickness, elongation, tensile, burst, tear, puncture, and heat seal strength specifications, etc. shall be provided to Seagate, including any supporting test data as required by Seagate Corporate Packaging.

7 ELECTRICAL TESTING REQUIREMENTS

The following tests are required for all ESD bags. The standard size bags for these tests are 6" x 8", 8" x 10", and 16" x 20". One lot shall be submitted for each bag size. The test report must contain the supplier name, film type, product ID with description, lot number, and date.

7.1 Surface Resistance Test

This test is performed to verify the electrical resistance characteristics of the bag material surface using ANSI/ESD S11.11. See Table 1 for sample sizes.

TABLE 1: Sample Sizes

Test	Bag Size 8" x 10"	Bag Size 6" x 8"	Bag Size 16" x 20"
Surface Resistance Test (Inside Bag)	6	2	2
Surface Resistance Test (Outside Bag)	6	2	2
Static Discharge Shielding Test per 12% R.H.	6	2	2
Static Discharge Shielding Test per 50% R.H.	6	2	2
Charge Retention, 2 kV, 12% R.H.	6	2	2
Charge Retention, 5 kV, 12% R.H.	6	2	2
Charge Retention, 10 kV, 12% R.H.	6	2	2
Charge Retention, 15 kV, 12% R.H.	6	2	2
Charge Retention, 2 kV, 50% R.H.	6	2	2
Charge Retention, 5 kV, 50% R.H.	6	2	2
Charge Retention, 10 kV, 50% R.H.	6	2	2
Charge Retention, 15 kV, 50% R.H.	6	2	2

100 bags for each or one lot of the three sizes, 8" x 10", 6" x 8", and 16" x 20", should be submitted for testing. Testing Lab will randomly sample the bags from the three different lots/sizes.

The following equipment and standards should be used to perform this test:

7.1.1 Contact Electrode

The implementation of this test method requires a specific concentric ring electrode.

7.1.2 Self-Contained Resistance Measurement Device

This test method requires a self-contained current and voltage apparatus capable of measuring resistance at 10 Volts and 100 Volts.

7.1.3 Insulative Test Surface

A surface with a resistance of $>10^{13}$ Ω, when measured according to ANSI/EOS/ESD S11.11, of suitable size to accommodate all test specimens, shall be available for use as a test bed.

7.1.4 Sample Conditioning

All samples shall be conditioned at a relative humidity of 12% ± 3% at a temperature of 23 ± 2 °C (73 ± 3 °F) for a minimum of 48 hours and a maximum of 72 hours prior to testing. All testing should take place in the conditioning environment or within 5 minutes of removal from the conditioning environment.

7.1.5 Test Verification

Commercially obtained test equipment are supplied with verification devices to assure accurate values. If commercial equipment is not used, appropriate test devices must be assembled according to ANSI/EOS/ESD S11.11.

7.1.6 Test Procedure

After conditioning as described in 7.1.4, the samples are placed on the insulative test surface (7.1.3). Testing must be completed in the conditioning environment. In use testing may be done for any materials; however, the relative humidity at the time of testing shall be recorded.

7.1.7 Reporting

Report the average, minimum, maximum, and standard deviation for all samples tested. If using this method for the periodic verification of materials in use, record the actual values.

7.1.8 Surface Resistance Acceptance Criteria

The limits for surface resistance for the inside and outside of packaging materials are:

$\leq 1 \text{ X } 10^{11} \Omega$

$\geq 1 \text{ X } 10^{4} \Omega$

Note: If any reading fails to meet the above limits, the lot shall be rejected.

7.2 Static Discharge Shielding Test

This test is performed per ANSI/ESD 11.31 to evaluate the performance of the ESD shielding and moisture barrier bags and pouches. The following equipment and standards should be used to perform this test. See Table 1 for sample size.

7.2.1 ESD Simulator

The equivalent circuit for the ESD Simulator consists of a 100 pF capacitor in series with a 1.5 kΩ resistor. The simulator and resultant wave forms are based on the Human Body Model as described in ANSI/EOS/ESD S5.1 - *Human Body Model (HBM) - Component Level.*

7.2.2 Wave Form Verification Equipment

Equipment capable of verifying the pulse wave forms defined in this standard shall include but is not limited to: a storage oscilloscope, a high voltage resistor and a suitable current probe.

7.2.3 Oscilloscope

A digital storage oscilloscope capable of a 200 MHz single shot bandwidth and a minimum sampling rate of 500 mega samples per second.

- The current probe shall be a Tektronix CT-1, or equivalent, with a maximum cable length of 1 meter.
- The resistor shall be a 500 ohm, 1% tolerance, 1000 volt, low inductance, sputtered metal film resistor (Caddock Industries type MG or equivalent).

7.2.4 Capacitive Probe

A parallel plate capacitive probe shall be constructed. The capacitance of the probe shall be 8 ± 2 pF. The probe capacitance can be verified per section 6.0 (C) of ANSI/ESD S11.31.

The spacer between the metal plates of the capacitive probe shall be made of an insulating material such as polycarbonate or acrylic.

7.2.5 Discharge Electrode and Ground Electrode

The discharge electrode and the ground electrode shall be 3.8 ± 0.025 cm (1.5 ± 0.010 inch) in diameter and be made of a conductive material.

The support area that surrounds the ground electrode should be 20 x 25 cm (8" x 10") and have a surface resistivity greater than 1 x 10^{12} ohms when measured according to Seagate Test Method - *Surface Resistance.*

7.2.6 Bag Size

The bags used for this test are listed in Table 1.

Note: If other sizes are used, care must be taken to ensure that the same size bag is used to provide consistent and fair comparison of bags from various manufacturers.

7.2.7 Computer/Software

A computer should be used to analyze the data that is acquired by the oscilloscope. A generic description of the analysis system is shown in Appendix A of ANSI/ESD S11.31.

7.2.8 Environmental Conditioning

A chamber that can meet the following two environmental test conditions is required:

- control humidity to 12% ± 3% R.H. at a temperature of 23 ± 2 °C (73 ± 3 °F).
- control humidity to 50% ± 5% R.H. at a temperature of 23 ± 2 °C (73 ± 3 °F).

7.2.9 ESD Simulator Waveform Verification Procedure

Verify that the ESD Simulator is capable of producing the desired wave form according to section 5 of ANSI/ESD S11.31.

7.2.10 System Verification Procedure

Verify that the assembled test system produces the correct peak current according to section 6 of ANSI/ESD S11.31.

7.2.11 Test Procedure/Conditioning

Condition a minimum of 6 samples of each bag type under evaluation in each of the conditions described in section 7.2.8. All testing is to be performed in the conditioning environment.

Place the capacitive probe into the test bag such that the probe is at the approximate geometric center of the bag.

Perform the test procedure according to sections 7C through 7G of ANSI/ESD S11.31.

7.2.12 Reporting

Report the average, minimum, maximum, and standard deviation of the energy readings for the sets of bags or pouches tested at each humidity level.

Record the following extra information:

- peak current
- bag size
- conditioning period
- test conditions
- ESD Simulator description
- Oscilloscope description and date of calibration

7.2.13 Static Discharge Shielding Acceptance Criteria

The maximum energy value for the set of bags tested shall be equal to or less than 15 nanojoules.

7.3 Charge Retention Testing

This test is performed to evaluate the ability of a laminated packaging material to trap a static charge on the conductive layer. Bags with a dissipative exterior will allow the majority of the charge to drain to the ground, thus allowing the part to be removed from the bag without travelling through a difference in electrical potential. The total sample size for this testing is listed in Table 1.

7.3.1 ESD Discharge Simulator

A high voltage discharge simulator with an IEC discharge network consisting of a 330 Ω resistor and 150 pF capacitor. The voltage level must be capable of being adjusted between 1 kV and 15 kV+.

7.3.2 Charged Plate Monitor (CPM)

A Charged Plate Monitor (CPM) meeting the specifications outlined in ANSI/EOS/ESD S3.1 *Ionization*, is used to measure the voltage potential on a plate inserted into a bag or pouch under test.

7.3.3 Metal Test Surface

A grounded metal (stainless steel preferred) test surface larger than the maximum size bag or pouch that will be evaluated. The bag or pouch under test must rest completely on the test surface without extending beyond the plate.

7.3.4 Sensi ng Plate

A square aluminum plate 11.5 x 11.5 cm (approximately 4.5 x 4.5 inches) by 6.35 mm (0.25 inch) thick. Insulating standoffs, approximately 6.25 mm thick (0.25 inch), are placed on the four corners of the bottom side of the plate. The plate is electrically attached to the sensing plate of the CPM with a high voltage wire.

7.3.5 Environmental Test Conditions

The two environmental conditions required for this test method are:

- control humidity to 12% ± 3% R.H. at a temperature of 23 ± 2 °C (73 ± 3 °F).
- control humidity to 50% ± 5% R.H. at a temperature of 23 ± 2 °C (73 ± 3 °F).

Testing must be accomplished in the conditioned environment.

7.3.6 Test Procedure

- The system must be temporarily grounded and all instrumentation set to zero.
- Place the aluminum sensing plate into the bag or pouch under test and center the plate side to side and top to bottom. Make sure the connecting wire to the plate of the CPM is attached securely.
- Adjust the Discharge Simulator to produce a 2 kV discharge.
  a. One discharge is directed to each of the four corners of the sensing plate.
  b. One discharge is directed to the center of the sensing plate.
  c. Each bag or pouch under test to receive five discharges in a total period of 10 seconds or less.

Note: During the discharge sequence, the aluminum plate will share the voltage present inside the bag (if any) with the plate of the CPM.

- Observe the peak voltage value indicated on the CPM, 10 seconds after the fifth (5th) discharge.
- Repeat test procedure with simulator discharges of 5 kV, 10 kV, and 15 kV.

7.3.7 Reporting

Record the peak voltage observed for each bag or pouch at each discharge voltage level and R.H. In addition record the following information:

- Equipment calibration date(s)
- Bag size
- Conditioning period
- ESD Simulator description
- Other test conditions

7.3.8 Charge Retention Acceptance Criteria

The maximum allowed voltage observed under any of the discharge conditions 10 seconds after the 5th discharge shall be less than 50 volts, except for moisture barrier bags.

Note: Currently there are no pass or fail criteria for moisture barrier bags. The data will be used for evaluation purposes only.

pair

8 CLEANLINESS TEST REQUIREMENTS

The following testing is required to qualify ESD bags used to store parts such as HGAs, E-Blocks, internal disk drive components, etc. Non-Volatile Residue (NVR) Extractable Ions, FTIR and Particle Count testing shall be performed in accordance with Seagate Specification 35344-001. The sample size to submit bags for testing shall be three (3) production lots.

8.1 Non-Volatile Residue (NVR) Acceptance Criteria

Shielding and Vacuum Deposit Metallized bags shall be tested for NVR using Hexane/IPA and DI (concentration level of 50/50 by volume). The NVR level shall not exceed the following:

- Shielding/Bag

  2.2 $\mu g/cm^2$ Hexane/IPA

  0.5 $\mu g/cm^2$ DI

- Foil Laminated and Vacuum Deposited Metallized Bag

  4.5 $\mu g/cm^2$ Hexane/IPA

  1.3 $\mu g/cm^2$ DI

Residues shall contain no detectable silicone, phthalate esters, or amide when tested by the FTIR/ATR method in 35344-001 on an instrument having a detection limit for silicone of 0.05 μg (2 times the RMS noise). A surface area of 100 cm^2 should be used.

8.2 Ionic Contamination Acceptance Criteria

The Chloride anion level shall not exceed 0.01 $\mu g/cm^2$. Bags are to be tested for Chloride concentration using DI water. Concentration of all anions shall be <0.05 $\mu g/cm^2$ with no single anion to exceed 0.01 $\mu g/cm^2$.

8.3 Particle Count Acceptance Criteria

Total particles sizes 0.5 micron or greater shall not exceed the following:

- Shield Bag

  4000 particles/cm^2

- Foil Laminated/Vacuum Deposited Metallized Bag

  4000 particles/cm^2

Note: Testing done on bag interior. Results based on average of three sample trails.

8.4 Outgassing Criteria

Combined BHT

Ional2	Hydrocarbons & others	Total
<530 **ng/cm²**	**<770 ng/cm²**	<1028 **ng/cm²**

8.5 Visual Inspection

No evidence of oil, grease, metal chips, or other contaminants shall be visible to 20X.

8.6 Environmental Testing

Minimum 85/85 environmental testing is to consist of placing 10 sliders in each of five loosely covered HGA or slider tray sets and placing the tray sets into five bags. HGA tray sets are to be used if they will fit into the bags being tested. Otherwise, 2" x 2" slider trays are to be used. The openings of the bags are to be slightly rolled back to open and allow the airflow of hot moist air into the bag during 85/85 testing. No corrosion is to be detected by 1000X (minimum) inspection after one 85/85 cycle.

9 APPROVED SUPPLIERS

The tests listed in this specification are required to qualify a supplier's bag using a particular type of film. Additional testing for application purpose may be required by Seagate Corporate Packaging. If the supplier changes the process in a manner that could affect form, fit, or function, additional testing will be required to meet this specification. Additional sizes of bags may be requested for testing by Seagate.

Refer to the Seagate Approved Supplier List (ASL) for approved suppliers.